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DEPARTMENT OF COMMERCE

UNITED STATES BUREAU OF MINES
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EXPLOSIONS IN TENNESSEE COAL MINES

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EXPLOSIONS IN TENNESSEE COAL MINES 1/

By H. B. Humphrey 2/

INTRODUCTION

In the 39 years from 1891 to 1929, gas and dust explosions in the coal mines of Tennessee caused 413 deaths, or one-third of the fatalities in the mines for that period. Inasmuch as explosions caused but about 15 per cent of mine fatalities for the whole United States for this same period it is evident that the Tennessee coal mining record is by no means good, as far as explosion fatalities are concerned. Since 1926, Tennessee has had a clear record as to fatalities from explosions; this fact may be credited very largely to the improved conditions and safer practices in Tennessee's coal mines which have been brought about by the work of the State Inspection Department and of the Southern Appalachian Coal Operators' Association directed toward adoption of safety precautions and practices most of which are advocated by the United States Bureau of Mines. Chief among these improvements are the replacement of black powder and dynamite by permissible explosives, improved ventilation, and the installation of rigid methods of inspection for gas. With the present tendency for operations to pass into the hands of responsible and informed management, and with unrelaxed care and inspection, the good record of the past several years should be maintained.

ACKNOWLEDGMENTS

Material for this paper was obtained through the offices of A. W. Evans, Chief Mine Inspector, Nashville, Tenn., and from United States Bureau of Mines Bulletins 115, 196, and 293 on coal mine fatalities in the United States. Reports of Bureau of Mines engineers on explosions were consulted and F. E. Cash, district engineer, assisted with information as to conditions and practices in Tennessee mines.

DISCUSSION OF DISASTERS

Table 1 is a list of the fatalities from gas and dust explosions from 1891 through 1929, as obtained from the reports of the State inspector, the reports of bureau engineers and from the bulletins on coal mine fatalities published by the Bureau of Mines. Except for cases occurring during the war

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1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6424."

2/ Assistant engineer, U. S. Bureau of Mines, Mine Safety Station, Birmingham, Ala.

Date	Company and mine	Type	Origin	Class mine	Explosive used	Killed
1891 Jan.	Coal Creek Coal Co. Thistle mine	Gas	Open light	B	Black Powder	1
Oct.	Roane Iron Co. Rockwood mine	do.	do.	A	do.	1
1895 Dec. 20	Dayton Coal & Iron Co. Nelson mine	Gas and dust	Blown-out shot	B	do.	28
1898- 1899		Gas do.	Unknown do.			1 1
1901 May 27	Dayton Coal & Iron Co. Richland mine	Dust	Blown-out shot keg of powder	C	B. P.	20
1902 Mar. 31	Dayton Coal & Iron Co. Nelson mine	Gas and dust	Blown-out shot	B	B. P.	16
1902 May 19	Coal Creek Coal Co. Fraterville # 1 mine	do.	Open light	B	B. P.	184
1904		Gas	Unknown			1
1904 Jan. 5	Poplar Creek Coal Co. Big Mountain mine	Dust	Blown-out shot	A	B. P.	3
1906	Roane Iron Co. Rockwood mine	Gas	Open light	A	Dynamite and B. P.	1
1907 July 14	Bear Wallow Coal Co. Bear Wallow mine	do.	do.	A	Dynamite and B. P.	1
1907 Nov. 1	Windrock Coal & Coke Co. Windrock mine	do.	Blown-out shot	C	Dynamite and B. P.	1
1907 Dec. 23	Bowling Coal Co. Bowling mine	do.	Open light	C	Dynamite and B. P.	1
1909 Sept. 21	LaFollette C. I. & R. R. Co. Rex No. 2 mine	Gas and dust	Blown-out shot	A	Dynamite and B. P.	1
1910 Dec. 23	W. Phillips Paint Rock No. 3 mine	Dust	do.	C	Dynamite and B. P.	3
1911 Dec. 9	Knoxville Iron Co. Cross Mountain No.1 mine	Gas and dust	Open light	B	B. P.	84
1913	State of Tennessee State mine, Petros	Fire and gas	Fire, origin ?	A	Permissible B. P.	1

Date	Company and mine	Type	Origin	Class mine	Explosive used	Killed
1914 Aug. 18	Durham Coal & Iron Co. Soddy 1-2	Dust	Blown-out shot	C	B. P.	1
1915 Apr.		CO_2 Gas	Suffocation			1
1917 Oct.		Gas	Open light			1
1917 Dec. 20	Barbour Coal & Coke Co. Nemo mine	Dust	Blown-out shot	C	B. P.	11
1919 Mar. 9	Bills Branch Coal Co. Bills Branch No. 1 mine	Gas	Open light	D		1
1919 Dec. 24	Paint Rock Coal Corp. Paint Rock No. 1 mine	Dust	Blown-out shot	B	B. P.	1
1920 Feb. 3	Pemberton-Hibbler Min. Co. Hibbler No. 1 mine	do.	do.	C	B. P.	1
1922 Nov. 20	Highland Coal & Lbr. Co. Highland No. 3 mine	Gas and dust	Blown-out shot	B	B. P. and Dynamite	1
1923 Feb. 26	East Laurel Mining Co. East Laurel mine	CO_2 gas	Suffocation	D	B. P.	1
1923 Dec. 10	Windrock Coal & Coke Co. Windrock mine	Dust	Blown-out shot	C	B. P.	2
1924 Dec. 31	Vaspar Coal Mining Co. Vaspar mine	Gas	Open light	A	B. P.	3
1925 Jan. 5	Roane Iron Co. Rockwood mine	do.	do.	A	Permissible[1]	2
1925 July 23	Roane Iron Co. Rockwood mine	Gas and dust	Open light	A	Permissible	10
1925 Dec. 9	Jackson-Laxton Coal Co. Hagemeyer mine	Gas	Ignition open light	C		1
1926 Oct. 4	Roane Iron Co. Rockwood mine	Gas	Open light	A	Permissible	27

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[1] Overloaded and tamped with coal-dust.

Original from THE OHIO STATE UNIVERSITY

years when no State reports were published and in 1898, 1899, and 1904, the causes of injury are given, with the class of mine and the number killed. According to the State mining laws, Class A mines are those liberating methane; Class B mines are those dangerously dry and dusty; Class C mines include all mines not in Class A or B, employing over 20 men and 3 mules; Class D includes those employing less men than Class C mines.

In classifying mines the presence of methane is determined by detection with a flame safety lamp.

Of the 413 deaths, Class A mines had 50, Class B had 315, Class C had 41, Class D had 2, and 5 occurred in mines, the classification of which is not known. In 1914 there were 20 Class A mines listed and 7 Class B; in 1926 there were 14 of Class A and 2 of Class B and in 1927 there were 7 of Class A and 4 of Class B. This predominance of Class B is due to bad disasters in mines which were in Class B but which also liberated gas. Of all the explosions listed, 10 were in Class A; 7 in Class B; 9 in Class C; 2 in Class D; and 5 in unlisted mines.

Table 2 gives those explosions classed as major disasters in which five or more men were killed.

Table 2. - Major disasters

Date	Mine	Class	Type	Origin	Explosive used	Killed
1895	Nelson	B	Gas and dust	Blown-out shot	Black powder	28
1901	Richland	C	do.	do.	do.	20
1902	Nelson	B	do.	do.	do.	16
1902	Fraterville	B	do.	Open light	do.	184
1911	Cross Mt.	B	do.	do.	do.	84
1917	Nemo	C	Dust	Blown-out shot	do.	11
1925	Rockwood	A	Gas and dust	Open light	Permissible	10
1926	do.	A	do.	do.	do.	27
Total	--	--	--	--	--	380

The one class A mine in this list had two disasters with 37 killed; this mine is now closed, the equipment has been withdrawn, and operations are suspended indefinitely. Three Class B mines had four explosions with 312 deaths, and the other two explosions were in Class C mines with 31 killed; dust was a factor in every case in propagating the explosion. The two greatest disasters were in Class B mines and were set off by open lights in accumulations of gas. Of the eight major disasters four were set off by open lights and four by blown-out shots, where black blasting powder or black blasting powder and dynamite were used.

Table 3.- Explosions classified by type

Type	No.	Fatalities	Percentage	
			Explosions	Fatalities
Gas	17	20	52	5
Dust	8	42	24	10
Gas and dust	8	351	24	85
Total	33	413	100	100

Seventeen of the total explosions, or over 50 per cent, were caused by the ignition of gas alone and resulted in 20 deaths; eight disasters with 42 deaths were due to explosion of suspended dust, and the remaining eight were combined gas and dust explosions resulting in 351 deaths.

Of the 17 gas ignitions, 15 caused single fatalities, one resulted in three deaths, and the other in two deaths. Of these, 6 occurred in Class A mines, 1 in Class B mines, 3 in Class C, 2 in Class D, and 5 in mines not listed. Less than half occurred in mines classed as gassy, and more than half were in Classes C and D.

Dust explosions occurred in one Class B mine with 1 fatality and seven Class C mines with from 1 to 20 fatalities in each.

Three gas and dust explosions occurred in Class A mines and five in Class B mines, all except two being major disasters; this shows that the mines having the worst disasters were recognized and labeled as dangerous. There were 351 men killed in these eight explosions, two of which caused single fatalities, and the rest resulting in from 10 to 184 deaths per explosion. These occurrences formed less than one-fourth of those recorded but they had 85 per cent of the fatalities.

Origin of Explosions

Table 4. - Explosions classified by origin

Origin	All explosions		Per cent		Major disasters		Per cent	
	Number	Fatalities	Explosions	Fatalities	Number	Fatalities	Explosions	Fatalities
Open light------	14	318	42	77	4	305	50	80
Blown-out shot	13	89	40	21	4	75	50	20
Uncertain ------	3	3	9	1	-	--	--	--
Miscellaneous	3	3	9	1	-	--	--	--
Total	33	413	100	100	8	380	100	100

Table 4 gives data concerning the origin, number, and the fatalities resulting from all explosions and from major disasters only.

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The peculiar feature of this district is that essentially half of the explosions, both major and minor, have been caused by open lights and about half by blown-out shots, the latter being evidence of past unsafe shooting practice. Open lights have been the chief cause of ignition since 1924. No proved cases of electrical origin have occurred; this may be explained by the fact that there are few gassy mines and there is relatively little use of electrical equipment. However, the danger from electricity will increase as its use is extended, making it needful to keep open type electrically operated machines from gassy workings and to keep gas and suspended coal-dust from contact with electrical installations by the use of adequate and controlled ventilation, rock-dust, and water. Some cases of suffocation have occurred, probab chargeable to poor ventilation. In both major and minor explosions, open lig caused about 80 per cent of the fatalities and blown-out shots 20 per cent; th figure is not of as much significance as might be given to it since it is larg ly a result of the death of 184 men at one time in 1902 in an explosion set o by an open light.

Small "local ignitions" should be guarded against by the use of clos lights in any mines where accumulations of gas may occur, and by proper inspection and ventilation to prevent such accumulations. These "local ignitions" are potential disasters, much easier to prevent than to control.

CONCLUSIONS

Experience of several years has shown that explosions are preventab in Tennessee coal mines as well as in coal mines everywhere else. The good record since 1926 can be maintained in the future by frequent and rigid inspection, efficient supervision, and the proper use of ventilation, rock-dust, wat and of permissible equipment and explosives in mines which are or are likely t be gassy or dusty.

The adoption and extension of the use of electrical equipment must b accompanied by such safeguards as will prevent the ignition of gas accumulati or suspended coal-dust by possible arcing or short circuiting.